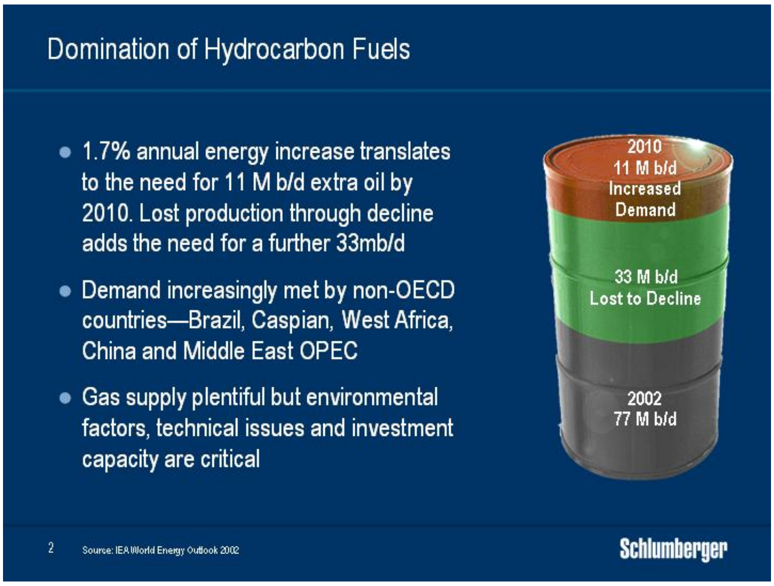
LONG-TERM OIL SUPPLY OUTLOOK—CONSTRAINTS ON INCREASING PRODUCTION CAPACITY

Ladies and gentlemen, good morning. Thank you once again for the opportunity to be at Oil and Money, and thank you to Energy Intelligence and the International Herald Tribune for putting together such an interesting program within the context of "Shifting Power in The Global Oil Industry". I'm going to leave the more complex subjects of supply, demand and reserves to my fellow panel members so that I can focus on two constraints that I know to be of critical importance—people and technology. But before I do that, I would like to discuss how we view the current industry context, and how that context presents challenges for all of us to answer.

Let me start by looking again at something I presented back in 2003.



At that time, this slide summarized the task that we saw facing the industry. The figures, from the 2002 IEA World Energy Outlook, forecast that 2002 oil production of 77 mb/d would need to grow to 88 million by 2010. The same forecast also predicted that this increase would be dwarfed by the 33 mb/d required to replace production lost to decline. We now know that world oil production is likely to reach the 88 mb/d level perhaps as early as this coming winter—almost two years ahead of time. So what happened to change this picture and why is the industry challenged in expanding capacity to meet the increased demand?

By far the most important factor has been the dramatic increase in demand between 2003 and 2006 driven by the strength of the US economy, and by the acceleration in growth among the developing economies. Over this period demand increased by a colossal 5.8 mb/d—almost equal to the combined production of the North Sea and Mexico. Our industry simply cannot cope with changes of this magnitude. Investment decisions, project durations, capital and resource allocations work on much longer time frames. Furthermore, the lack of upstream investment in the long period following the collapse of the oil price in the mid 1980s has meant that we face huge difficulty in ensuring adequate cushions of spare production capacity.

There are however other reasons affecting our ability as an industry to respond.

First, heightened resource nationalism around the world has limited investment opportunities for private international capital. This trend is having a fundamental effect on the technology developed by the oilfield service industry as more and more exploration and development work is undertaken directly by the national oil companies.

Second, the industry has generally failed to replace those oil reserves being consumed. Declining trends in exploration spending over the past decade have reversed, but average field size discovered has decreased.

Third, the difficulty in stemming decline rates and bringing new non-OPEC production on line and on time has increased and this can be seen by comparing recent IEA non-OPEC production forecasts. In 2006, the forecast for non-OPEC production in 2010 was just over 53.5 mb/d. This year the corresponding forecast has slipped to under 52 million barrels. Fourth, the efforts of the industry to increase investment have not only led to shortages, but also to high cost inflation. And although recent rates of increase may have slowed, this has still meant that the effectiveness of the additional investment has been reduced.

Lastly, the industry is facing a significant shortage of experienced professionals in almost every part of the business. Years of underinvestment in new talent have led to a limited and ageing pool of skilled workers. Their replacement cannot occur overnight, and while the industry has begun to hire again in considerable quantity, it is going to take time to train the large numbers of new employees that will be needed.

These inherent fragilities in the oil and gas supply chain mean that the long-term oil supply outlook is more complex than originally thought. For perhaps the first time in more than 30 years the industry will need to pursue exploration for new reserves while growing and sustaining existing production of both oil and natural gas. Within this context there are a number of challenges currently facing the service industry in helping increase production capacity.

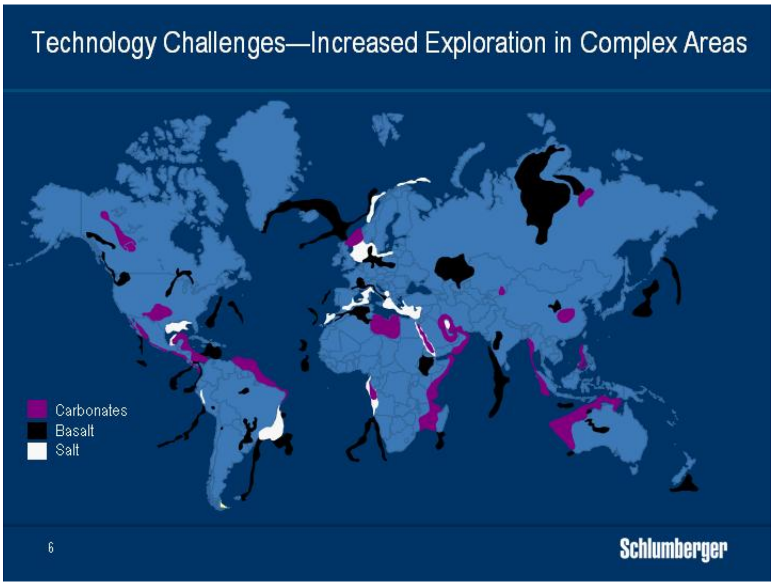
The first of these is the trend towards new exploration in both known hydrocarbon-producing basins and in more remote green-field locations. The economics of sustained higher oil prices are making complex exploration plays more attractive, and this will affect the technologies that will be required, as well as the speed and geographical location of their deployment.

Second, this new wave of exploration in no way diminishes the technology required to improve the performance of the existing production base where 70% of the fields have been producing for more than 30 years. Stemming production decline is crucial, and technology requirements can only accelerate.

Third, the age of easy oil is over, and there will be a growing shift to more and more unconventional hydrocarbon resources. The growing service intensity required to produce unconventional natural gas in North America is just one example of this particular challenge. The move to heavier oil production in areas such as Canada and Venezuela is another.

Lastly, the industry will continue to struggle with the lack of trained professionals that I mentioned earlier. While this will begin with recruiting and initial training, it will need to continue in such a way that new employees are brought rapidly to levels of competence that permit autonomous decision-making earlier than before. As a result, systems for the effective use of limited human resources will become more and more prevalent. There is of course one vital prerequisite here that we often tend to neglect—and that is the need to attract more students to science and engineering education in the first place.

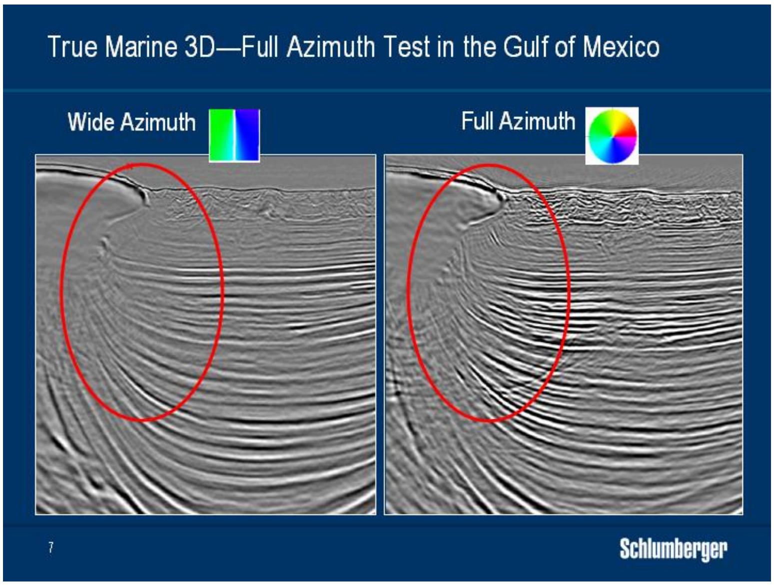
Now I don't have time this morning to discuss all of these challenges in detail, but I would just like to show you one area where substantial technological progress is being made in finding and developing reserves in complex environments. But first let me define what I mean by complex. This may be because the reserves are remote geographically, or difficult to access geologically, or complicated to produce dynamically. And complexity does not only exist in the more difficult regions now being explored—it also exists in established production areas such as the Gulf of Mexico where oil and gas have produced for at least 40 years but where new reserves lie beneath difficult-to-evaluate salt formations.



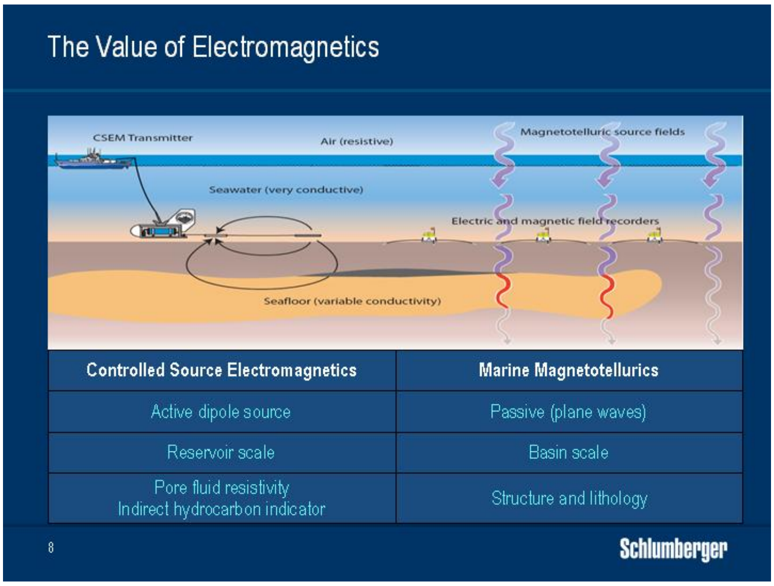
This map shows a number of potential regions where exploration targets lie beneath salt and basalt—two rocks that render seismic imaging complex. It also shows regions of carbonate reservoirs, which present other challenges due to their extensive heterogeneity. Luckily new technology is giving the industry improved visibility into such resources.

Seismic imaging for example has made significant progress over the last five years as new techniques have brought huge improvements in quality through low-noise measurements that reveal subtle details of the subsurface. As more experience has been gained, more advanced surveys—such as rich- and wide-azimuth applications where the source is laterally offset—have already increased understanding of more complex environments.

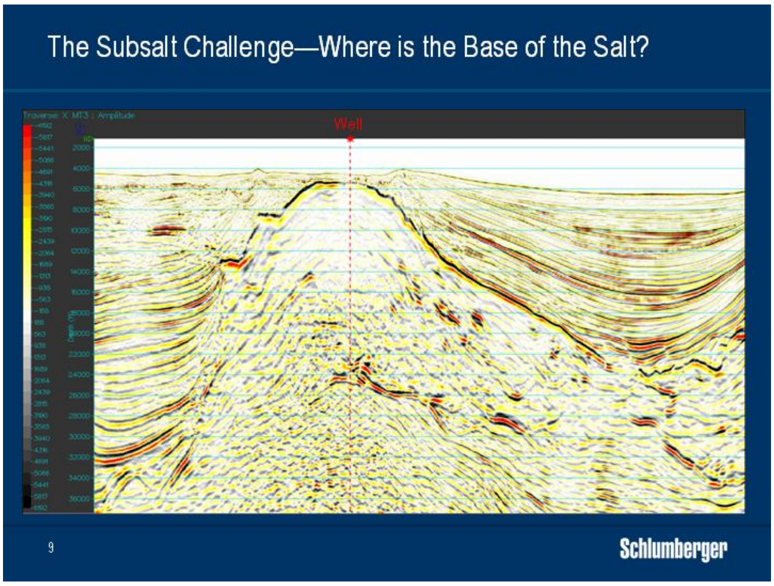
While such surveys are undoubtedly making an impact on complex imaging challenges, we believe that further innovation is yet to come.



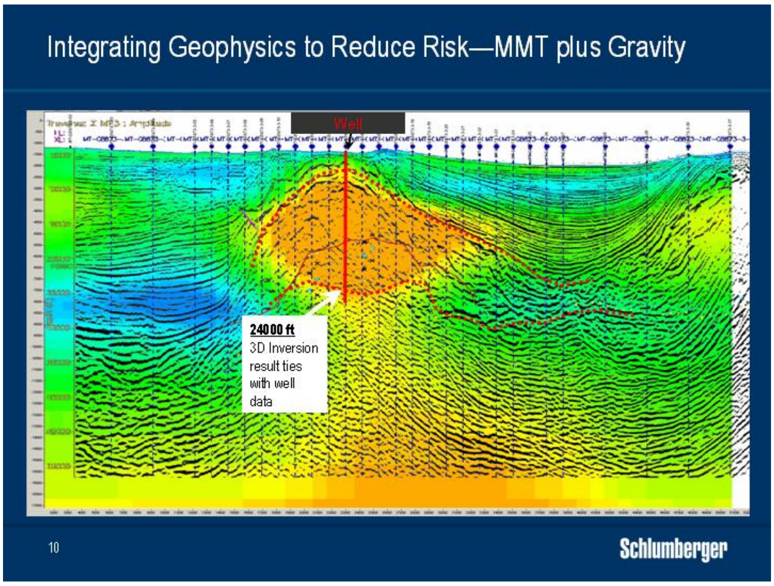
Indeed, the Holy Grail from a geophysical perspective is data with full-azimuth illumination, which in marine means that the survey vessel is almost always turning to illuminate the target from every angle. This is not an easy task, but as you can see, such shooting geometry produces dramatically improved results over and above the wide-azimuth deployments that represent the current state-of-the-art.



But even the best seismic data can benefit from integration with other measurement technologies. One example of this is the emerging technology of deep electromagnetic imaging. Based on magneto-telluric and controlled source electromagnetic measurements, the technology brings a new dimension by adding information that can distinguish potential hydrocarbon-bearing structures from those that most certainly do not. The two new measurement types are themselves complementary, as their differing characteristics clearly show here.

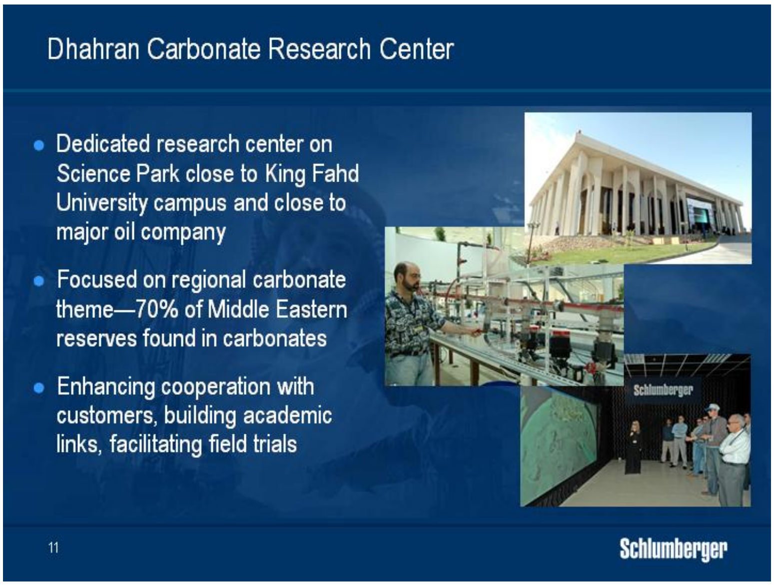


To give you an example of what full geophysical measurement integration can bring, consider this example from the deepwater Gulf of Mexico. The image shown here depicts two key challenges in salt-prone environments that affect all aspects of finding and producing hydrocarbons within such complex areas—namely, where is the base of salt and where is the reservoir? The seismic image is unclear.



Look now at this integrated plot where seismic, electromagnetic and gravity data have been combined. The seismic image is in the background but is overlaid by the results of a 3D joint inversion of gravity data simultaneously constrained by magneto-telluric and seismic measurements. This has combined the various measurements to reduce uncertainty and improve the drilling decisions that must be made. While it is early days still for this technique, we believe that the approach will bring significant long-term progress to complex reservoir characterization.

But new technical challenges such as these require new models of oilfield research and development that bring people and technology into greater contact. Our new purpose-built research center in Saudi Arabia is one example of how we see this developing.



This new center is destined to become a focal point for the study of carbonate reservoirs—which hold about 60% of the world's proven conventional oil reserves and nearly 40% of the world's gas reserves. Further, 70% of the oil reserves in the Middle East lie in carbonate reservoirs—yet they remain less well understood than their sandstone equivalents, and research on their behavior as reservoirs will be key to loosening some of the constraints on longer-term hydrocarbon production.

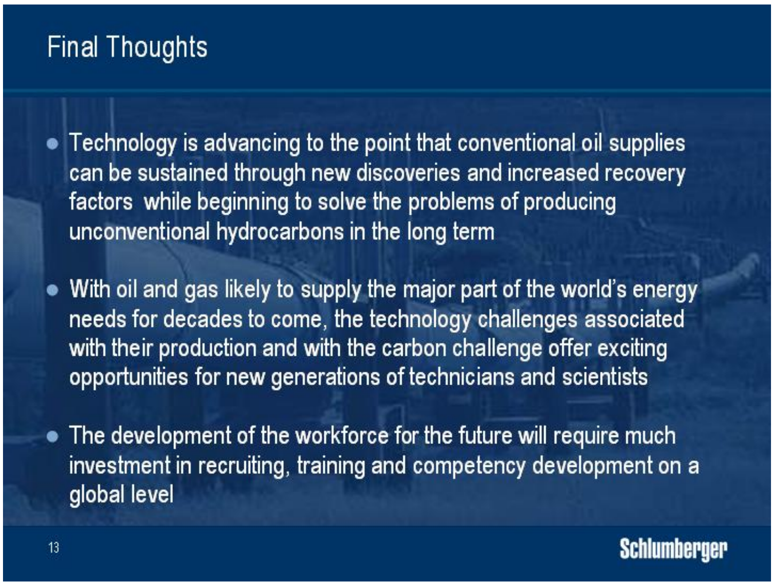
Locating the center in this region therefore made perfect sense, but two other factors governed this choice. Not only being close to the headquarters of a major oil company—it is also close to one of the world's leading universities in the education of petroleum engineers and scientists. In our view, this is a modern model for oilfield research and development activity harnessing as it does research facilities, access to academia and proximity to the end user with producing oilfields nearby.

This model is already bearing its first fruit. For example, we are jointly developing technology in key areas of fluid movement monitoring using deep resistivity imaging as well as by use of new-generation borehole gravimetry techniques. After all, measuring and understanding fluid movement is of critical importance in increasing reservoir recovery and deep imaging will improve understanding in this area.

Among the challenges that I identified earlier was the new generation of skilled people that the industry will need both now and in the longer term. The sheer scale of this can be seen from the fact that in the last two years Schlumberger has recruited 6,000 engineers in 80 countries from 122 universities in answer to today's demands, let alone tomorrow's. Such figures show that while the scientific educational machine can meet the demand, recruiting must occur on a global level, and this will have implications for us all in managing employee career paths.

But the real challenge comes in managing the transfer of knowledge and the development of autonomous decision making among a young industry generation. This will not be easy. They will have to assimilate more technology, more rapidly than any previous population, and they will have to do so in an era of greater reservoir challenges. We must therefore look at how to make our human resources more productive much earlier. Competency development, knowledge management, new oilfield technology, workflow process improvement, technical career development and better management of retiring senior employees are all part of the solution.

New communications technologies are helping here. For example the real-time operations centers needed to drill today's complex well trajectories can bring expert coaching and counsel to less-experienced crews on remote operations. But this already assumes an initial level of knowledge. Hiring people is one thing—training them is another and, we see more and more benefit in a uniform operating structure in which the various technologies needed in the oilfield can leverage each other. Consequently three years ago we opened the first of a series of new-generation of training facilities that cater to a number of different technology services. Since then we have begun construction of two more, one in Russia and one in Abu Dhabi.



Ladies and gentlemen, in this short presentation I have described some of the technology challenges that must be solved to ensure continuing energy security from oil and gas supply until alternative energies can make meaningful contributions. I've also tried to give a brief overview of the progress that is being made in developing technology.

Indeed, new technology will solve many of the problems of exploring and producing the more complex reservoirs of the future that will also include deposits of increasingly non-conventional hydrocarbons. It will also enable the industry to extend the size, and increase the recovery of existing conventional oil reserves in the short term.

However, the challenges we face in developing future technologies are themselves formidable. These encompass new physics and chemistry, new materials for higher temperatures and pressures, new modeling, inversion and simulation techniques, new geophysics, geology and geochemical research, new low energy recovery mechanisms, new approaches to the environmental consequences of produced water as well as the need to address the challenge of carbon capture and storage.

Finally ladies and gentlemen, in addition to new technologies, we will also need to recruit and train the new generations of engineers and scientists that will be needed to perform the task ahead.

Thank you very much.